Remarks

There is no amendment to the claims in this response.

Marked-up Set of Claims (According to 37 CFR 1.173(b)(2))

1. (Ten times amended) A method for dewatering biological sludge [that has been digested by]from a thermophilic digestion process, comprising:

a. adding a polymeric quaternary ammonium compound[s], as primary component, to the biological sludge; and

b. adding [polyacrylamide]to the biological sludge a cationic polyacrylamide or separate from the polymeric quaternary ammonium compound adding an anionic polyacrylamide;

such that [any combinations of] the polymeric quaternary ammonium compound[s] and [of]the polyacrylamide[s] enhance dewatering of the sludge.

2. (Ten times amended) The method for dewatering biological sludge according to claim 1, wherein [the]said polymeric quaternary ammonium compound[s] is[are from] poly(di-allyl di-methyl ammonium chloride) (poly(DADMAC))[family].

3. (Eleven times amended) The method for dewatering biological sludge according to claim 1, wherein [the]said polymeric quaternary ammonium compound[s] is[are from] poly(epichlorohydrin di-methyl amine) (poly(epi-DMA))[family].

4. (Four times amended) The method for dewatering biological sludge according to claim 1, wherein [the]said polymeric quaternary ammonium compound is added directly to the sludge; and

[, upon]following the formation of microflocs of the sludge from addition of the polymeric quaternary ammonium compound, [a]said cationic polyacrylamide is added[to form a floc that dewaters the sludge].

5. (Four times amended) The method for dewatering biological sludge according to claim 4, wherein [the]said polymeric quaternary ammonium compound and [the]said cationic polyacrylamide are in an approximate[ly] 1:1 ratio, with [the]said cationic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound[does].

6. (Four times amended) The method for dewatering biological sludge according to claim 4, wherein the ratio[s] of [the]said polymeric quaternary ammonium compound with respect to [the]said cationic polyacrylamide range from about 1:10 to about 20:1.

7. (Twice amended) The method for dewatering biological sludge according to claim 4, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between about 50 ppm:1 percent and about 300 ppm:1 percent.

8. (Three times amended) The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is added directly to the sludge[, in an amount sufficient to cause formation of a cationic overcharge within a developed microfloc system], and wherein said polyacrylamide is[and an] anionic[polyacrylamide is then added for final floc formation].

9. (Cancelled)

10. (Five times amended) The method for dewatering biological sludge according to claim 8, wherein [the]said polymeric quaternary ammonium compound and [the]said anionic polyacrylamide are in an approximate[ly] 10:1 ratio, with [the]said anionic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound[does].

11. (Amended) The method for dewatering biological sludge according to claim 10, wherein [the]said anionic polyacrylamide is about 40% anionic.

12. (Four times amended) The method for dewatering biological sludge according to claim 8, wherein the ratio[s] of [the]said polymeric quaternary ammonium compound to [the]said anionic polyacrylamide ranges from about 1:10 to about 20:1.

13. (Three times amended) The method for dewatering biological sludge according to claim 8, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between approximately 50 ppm:1 percent and approximately 300 ppm:1 percent.

14. (Original) The method for dewatering biological sludge according to claim 1, wherein the biological sludge is mixed with primary sludge.

15. (Ten times amended) [A composition]The method for dewatering biological sludge according to claim 1, [comprising] wherein said polymeric quaternary ammonium compound[s, as primary component, and] is added along with said cationic polyacrylamide[, said components being present in the composition in a ratio to enable the composition to function as an agent for dewatering biological sludge from a thermophilic digestion process].

16. (Nine times amended) The method for dewatering biological sludge according to claim 1, wherein [the]said cationic or anionic polyacrylamide and [the]said polymeric quaternary ammonium compound[s] are [used]added in solution [or in dry] form.

17 – 21. (Canceled)

22. (Four times amended) A method for dewatering sludge comprising water and solids, wherein the solids comprise thermophiles, the method comprising:

contacting the sludge with a polymeric quaternary ammonium compound along with a cationic polyacrylamide; or

contacting the sludge first with a polymeric quaternary ammonium compound and then with a cationic polyacrylamide;

to form a floc.

23. (Cancelled)

24. (Four times amended) The method of claim 22, wherein said polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000 and said cationic polyacrylamide comprises a molecular weight in the range of about 5,000,000 to about 16,000,000.

25. (Twice amended) The method of claim 22, wherein said polymeric quaternary ammonium compound is added in an amount sufficient to form microflocs of said thermophiles; and wherein said cationic polyacrylamide is added in an amount sufficient to agglomerate the microflocs into flocs for dewatering.

26. (Five times amended) The method of claim 22, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

27. (Twice amended) The method of claim 25, wherein the ratio of said polymeric quaternary ammonium compound to said cationic polyacrylamide is in the range of about 1:10 to about 20:1.

28. (Three times amended) The method of claim 25, wherein the concentration of said polymeric quaternary ammonium compound and said cationic polyacrylamide to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

29 – 32. (Canceled)

33. (Twice amended) A method for dewatering a sludge comprising water and thermophiles, the method comprising:

adding to the sludge a polymeric quaternary ammonium compound.

34. (Canceled)

35. (Three times amended) The method of claim 33, wherein said polymeric quaternary ammonium compound is added in an amount sufficient to form microflocs of the thermophiles.

36. (Five times amended) The method of claim 35, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

37. (Three times amended) The method of claim 35, wherein the concentration of said polymeric quaternary ammonium compound to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

38. (Five times amended) The method of claim 35, further comprising the addition of an anionic polyacrylamide for final floc formation.

39. (Cancelled)

40. (Three times amended) The method of claim 38, wherein the concentration of said polymeric quaternary ammonium compound to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

41. (Three times amended) A sludge composition comprising:

water;

polyacrylamide comprising a cationic or an anionic moiety;

a polymeric quaternary ammonium compound; and

solids comprising thermophiles.

42 – 43. (Cancelled)

44. (Five times amended) The sludge composition of claim 41, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

45. (Three times amended) The sludge composition of claim 41, wherein the ratio of said polymeric quaternary ammonium compound to said polyacrylamide is in the range of about 1:10 to about 20:1.

46. (Three times amended) The sludge composition of claim 41, wherein the concentration of said polymeric quaternary ammonium compound and said polyacrylamide to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

47. (Five times amended) The sludge composition of claim 41, wherein said polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000; wherein

said polyacrylamide comprises a cationic moiety having a molecular weight in the range of about 5,000,000 to about 16,000,000; or wherein

said polyacrylamide comprises an anionic moiety having a molecular weight in the range of about 5,000,000 to about 15,000,000.

48. (Four times amended) A sludge composition comprising:

water;

polyacrylamide comprising a cationic or an anionic moiety;

a polymeric quaternary ammonium compound; and

solids comprising flocs of thermophiles.

49 – 50. (Cancelled)

51. (Five times amended) The sludge composition of claim 48, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the

group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

52. (Three times amended) The sludge composition of claim 48, wherein the ratio of said polymeric quaternary ammonium compound to said polyacrylamide is in the range of about 1:10 to about 20:1.

53. (Three times amended) The sludge composition of claim 48, wherein the concentration of said polymeric quaternary ammonium compound and said polyacrylamide to the percentage of solids in said sludge is in the range of about 50 ppm:1 percent to about 300 ppm:1 percent.

54. (Five times amended) The sludge composition of claim 48, wherein said polymeric quaternary ammonium compound comprises a molecular weight in the range of about 500,000 to about 3,000,000, wherein

said polyacrylamide comprises a cationic moiety having a molecular weight in the range of about 5,000,000 to about 16,000,000; or wherein

said polyacrylamide comprises an anionic moiety having a molecular weight in the range of about 5,000,000 to about 15,000,000.

55. (Four times amended) A sludge composition comprising:

water;

a polymeric quaternary ammonium compound; and

solids comprising thermophiles.

56 – 57. (Cancelled)

58. (Five times amended) The sludge composition of claim 55, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

59 – 66. (Cancelled)

67. (Amended) A sludge composition comprising:

water;

thermophiles; and

a polymeric quaternary ammonium compound.

68. (Five times amended) The sludge composition of claim 67, wherein said polymeric quaternary ammonium compound comprises at least one compound selected from the group consisting of poly(di-allyl di-methyl ammonium chloride) and poly(epichlorohydrin di-methyl amine).

69. (Twice amended) The sludge composition of claim 67, wherein said polymeric quaternary ammonium compound is present in an amount sufficient to form microflocs of said thermophiles.

70. (Three times amended) The sludge composition of claim 67, further comprising a cationic or an anionic polyacrylamide.

71 – 72. (Canceled)

73. (Amended) The method of claim 33, wherein a cationic polyacrylamide is added.

74 – 79. (Canceled)

Claim List – Status and Support of Current Amendment Changes

Claim	Status	Type	Support of Changes
1	Pending	Method	There are no changes in this response.
2	Pending	Method	There are no changes in this response.
3	Pending	Method	There are no changes in this response.
4	Pending	Method	There are no changes in this response.
5	Pending	Method	There are no changes in this response.
6	Pending	Method	There are no changes in this response.
7	Pending	Method	There are no changes in this response.
8	Pending	Method	There are no changes in this response.
9	Cancelled	N/A	N/A
10	Pending	Method	There are no changes in this response.
11	Original	Method	There are no changes in this response.
12	Pending	Method	There are no changes in this response.
13	Pending	Method	There are no changes in this response.
14	Pending	Method	There are no changes in this response.
15	Pending	Method	There are no changes in this response.
16	Pending	Method	There are no changes in this response.
17-21	Cancelled	N/A	N/A
22	Pending	Method	There are no changes in this response.
23	Cancelled	N/A	N/A
24	Pending	Method	There are no changes in this response.
25	Pending	Method	There are no changes in this response.
26	Pending	Method	There are no changes in this response.
27	Pending	Method	There are no changes in this response.
28	Pending	Method	There are no changes in this response.
29-32	Canceled	N/A	N/A
33	Pending	Method	There are no changes in this response.
34	Cancelled	N/A	N/A
35	Pending	Method	There are no changes in this response.
36	Pending	Method	There are no changes in this response.
37	Pending	Method	There are no changes in this response.
38	Pending	Method	There are no changes in this response.
39	Cancelled	N/A	N/A
40	Pending	Method	There are no changes in this response.
41	Pending	Composition	There are no changes in this response.
42-43	Cancelled	N/A	N/A
44	Pending	Composition	There are no changes in this response.
45	Pending	Composition	There are no changes in this response.
46	Pending	Composition	There are no changes in this response.
47	Pending	Composition	There are no changes in this response.
48	Pending	Composition	There are no changes in this response.
49-50	Cancelled	N/A	N/A

51	Pending	Composition	There are no changes in this response.
52	Pending	Composition	There are no changes in this response.
53	Pending	Composition	There are no changes in this response.
54	Pending	Composition	There are no changes in this response.
55	Pending	Composition	There are no changes in this response.
56	Cancelled	N/A	N/A
57	Cancelled	N/A	N/A
58	Pending	Composition	There are no changes in this response.
59-66	Cancelled	N/A	N/A
67	Pending	Composition	There are no changes in this response.
68	Pending	Composition	There are no changes in this response.
69	Pending	Composition	There are no changes in this response.
70	Pending	Composition	There are no changes in this response.
71-72	Canceled	N/A	N/A
73	Pending	Method	There are no changes in this response.
74-79	Canceled	Method	N/A

Applicant's Responses to the Examiner's Rejections, Arguments and Objections

Examiner Rejection

112, second paragraph, Essential steps omitted

Claims 33, 35-38, and 40, directed to a sludge dewatering method, are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps. See MPEP § 2172.01. The omitted step are: 1) Contacting the sludge with polyacrylamide and 2) dewatering.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his response. In relation to claims 33-38, Applicant respectfully presents to the Examiner that "essential steps" have not been omitted. The Examiner's quotation from the specification is from the description of a specific chemical method, specifically method 1 (col. 5 lines 42-45) wherein is taught "the polyquaternary amine [sic] chemical components used in the chemical method is not large enough to create large enough flocs to dewater the sludge". This teaching is in contrast to a prior teaching within the specification, which again, does not relate to the four "4" distinct chemical Methods. Applicant specifically refers the Examiner to column 5 lines 2 through 4 of the instant specification, wherein is stated:

> "The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge."

Applicant also refers to col. 3 lines 60 – 63 of the instant specification, wherein is stated:

> "An additional object of the invention is to devise a method for dewatering of biological sludge that has been digested by a thermophilic digestion process with **polyquaternary amine being used as the primary component.**" **(Emphasis added)**

Therefore, and in conclusion, the polyacrylamide contemplated by the Examiner is only necessary and is only taught by Applicant to be necessary when the polymeric quaternary ammonium compound "is not large enough", e.g. within one of the four "4" Methods.

In relation to dewatering within claim 33, Applicant fails to see the Examiner's Argument; as, once the polymeric quaternary ammonium compound is added, as taught by Applicant and referenced previous, the water and the sludge have been separated. Therefore, there is no essential step missing.

In relation to dewatering within claims 33, 35-38 and 40, Applicant presents to the Examiner that this proceeding is not limited to Methods 1 and 2 within the instant specification. Applicant respectfully presents to the Examiner that there are teachings within the instant specification which are outside of Methods 1 and 2, as well as, Methods 3 and 4.

Further, Applicant respectfully presents that while Methods 3 and 4 have been restricted from this proceeding, such a restriction DOES NOT limit this proceeding to only Methods 1 and 2. Applicant, again, respectfully refers the Examiner to MPEP 1412.01 and the case law referenced therein, e.g. *In re Doyle*, as discussed further by Applicant/Owner previous in this proceeding. Applicant respectfully presents to the Examiner that the Examiner is reading limitations into the instant claims and/or restrictions into this proceeding; while, this is a re-issue proceeding.

Examiner Rejection

Eberhard, McGrow, and Williams

Claims 1 – 2, 4 – 8, 10 – 16, 22, 24-28, 33, 35-37, 41, 44, 45- 48, 51-55, 58, 67-70, 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5019267 to Eberhard in view of USP 5213693 to McGrow (incorporating 5178774 to Payne) and USP 5561520 to Willliams.

Applicant's Response

Applicant appreciates effort afforded by the Examiner in preparing his response.

McGrow states in col. 2:

> **Accordingly the commercially preferred process involved the adoption of a single treatment using a conventional high molecular weight cationic flocculant polymer, typically intrinsic viscosity 6 to 8 dl/g. This greatly reduces the treatment costs and gives results that have been considered adequate. However if the doses are not controlled accurately, and if overdosing occurs, there is a tendency to form large gelatinous**

Emphasis added

> **flocs which can release free water very quickly and cause blockage of feed holes, this effect being known as coring. Coring prevents full utilisation of the press chambers and so results in reduction in the volume of sludge that can be processed and it reduces the dry solids content of the resultant cake. Reducing the dose can permit better filling of the filter press but filterability is still inferior, leading to increased cycle time and reduced cake dry solids.**

Emphasis added

McGrow states again in col. 6 lines 30 - 45:

> **Compared to the traditional methods using the high molecular weight flocculant alone, the method of the invention gives numerous advantages. The flocs are small, evenly structured and highly filterable and have good shear stability, and the system is relatively resistant to overdosing. Thus the risk of the formation of gelatinous flocs with the consequential disadvantages of coring and reduced productivity can be avoided.**

Emphasis added

Therefore, while McGrow DOES NOT teach the dewatering of bio-solids from a thermophilic digestion process, McGrow specifically teaches that the use of a cationic polyacrylamide alone "greatly reduces the treatment costs and gives results that have been considered adequate". By the Examples provided in the instant specification, Applicant respectfully presents that in no way does a cationic polyacrylamide alone "greatly reduc[e] the treatment costs and giv[e] results that have been considered adequate [in the dewatering of biological sludge from a thermophilic digestion process]". Therefore, it is obvious that **McGrow is applied to a different application, e.g. a different purpose than that of the instant claims.**

McGrow, then, goes on to state that the McGrow invention provides "resistan[ce] to overdosing. Thus the risk of the formation of gelatinous flocs and coring *(from overdosing)* and the associated reduced productivity can be avoided". **Therefore, the teaching of McGrow is in the case of gelatin formation or coring resulting from overdosing. Neither of these challenges are taught or suggested in the instant application *or occur*** as a challenge in the dewatering of thermophiles, as evidenced in the instant specification.

In contrast to McGrow, as is claimed by and taught by Applicant, the dewatering of bio-solids from a thermophilic digestion process relate to the "**need**" to form of a floc that dewaters well as compared to mesophiles, specifically col. 1 lines 30 -55 states:

> "Meanwhile, traditional polyacrylamide polymers used for dewatering have been shown to perform very poorly in tests for dewatering of sludge that has been digested by any thermophilic digestion process. The goal of dewatering is to convert the sludge to a cake of such dryness that the dewatered sludge can be hauled as a solid to a final disposal site at minimal cost. To minimize the amount of sludge to be handled and to minimize dewatering and handling costs associated with the wasted sludge, most biological treatment systems waste the sludge to a digester or a digestion system."

Further, the instant specification states in col. 2 lines 25 – 36 state:

> "Despite the disadvantages of mesophilic bacteria, mesophilic bacteria are preferable in relation to the dewatering of digested sludge. Mesophilic bacteria naturally secrete a polysaccharide which acts as a tackifier providing a chemical mechanism of floc formation. This chemical mechanism is an aid to traditional cationic polyacrylamides to begin the dewatering process. However, thermophilic bacteria do not secrete a tackifying polysaccharide. Furthermore, thermophilic bacteria naturally repel each other. This repelling nature of thermophilic bacteria makes the dewatering of sludge from the thermophilic digestion process expensive and difficult."

Applicant also teaches and demonstrates in col. 4 lines 59 – 65:

> "The best performing traditional polyacrylamide technology utilized at the site of this invention was Nalco 9909, manufactured by Nalco Chemical, Inc. Usage of Nalco 9909 results in **a dry polymer dosage often near 2,000 ppm and usually near 1,700 ppm treating sludge near 4 percent solids. Even at this dosage, plant throughput was at 20 percent of rated capacity**." **(Emphasis added)**

This <u>horrendous</u> chemical dosage is in very strong contrast to any dosing discussion within McGrow, which taught an **overdose** situation, and is in strong contrast to any dosing taught within any of the Examiner's Citations. Further, this <u>horrendous</u> chemical dosage, by McGrow, <u>should have comprised gelatin or coring</u> for one of ordinary skill in the art to have applied McGrow.

Therefore, given the teachings of McGrow in combination with the facts of dewatering thermophiles, there is no reason for one of ordinary skill in the art to try the instant claims from the teachings of McGrow; as, McGrow teaches a solution to a different problem (purpose), which is specifically related to mesophiles and is in stark contrast to the problem (purpose) associated with thermophiles. Applicant refers the Examiner to MPEP 2141.02.

This is while an article by Dentel, Steven K. and Chitikela, Srinivasarao; Evaluation of Dual Chemical Conditioning and Dewatering of Anaerobically Digested Biosolids The Final Report Sludge Dewaterability Assessment for East Bay Municipal Utility District (EBMUD) California, June 1995 (Dentel 1995), and previously cited in this proceeding concludes on page 9 that:

> "As a rule of thumb, it appears that adding a proportion of one chemical's optimum dosage reduces the requirement for the other by the same amount.... If this rule were invariably true, it would always be most economical to use only one of the conditioning chemicals by itself. However, the CST results also indicated that sole use of ferric chloride or HDTMA (quaternary salt) did not provide adequate dewaterability even at the optimum dose..."

And, on page 11 that:

> "The use of ferric chloride or HDTMA (a quaternary salt) as a preconditioner can reduce the polymer requirement, this is not a cost effective option at current prices for these additives."

Therefore, as late as 1996, **time of the instant invention**, it was not known to be economical to "precondition" a biological sludge with a polyquaternary amine, regardless of the teachings of McGrow **in 1991**. If McGrow made it obvious to precondition bio-solids with a polyquaternary ammine, then why did Dentel and Chitikela, working for a well established University, directly **teach away** from McGrow 6 years later and at a time which is closer to the time of the instant invention? It is painfully obvious that McGrow did not even make it obvious to **economically** precondition mesophilic bio-solids with a polyquaternary ammine, **much less** teach to precondition **thermophilic** bio-solids with a polyquaternary ammine, per the instant claims.

The Dentel 1995 and Chitikela 1996 articles are timelier to the instant invention in 1996 than is McGrow in 1991. Therefore, Dentel 1995 and Chitikela 1996 are much closer references to the instant invention and the instant claims than is McGrow. Applicant refers the Examiner to MPEP 716.02(e).

The above is while Dentel 1995 further states on page 2 that:

> "The success of any conditioning process will also depend on the specific dewatering process employed.
>
> Thus, the conditioning process is <u>**a multivariate problem with no simple strategy available for optimization**</u>. At present, the required dosages for chemical conditioners must be determined empirically. With this being the case, <u>**the use of multiple chemical additives becomes less feasible because of the difficulty in identifying a proper dosage combination**</u>." **(Emphasis added)**

And, Chitikela 1996 further states that:

> "The success of any conditioning process will also depend on the specific dewatering process employed. Thus, the sludge conditioning process is a multivariate problem with no simple strategy available for its optimization. At present, the required dosages for

> chemical conditioners must be determined empirically. With this being the case, the use of multiple chemical additives become less feasible because of the difficulty in identifying a proper dose combination."

Therefore, the instant invention could not have been obvious at the time of filing for the instant invention; as: both Dentel 1995 and Chitikela 1996 taught not to practice the instant claims (teaching away), and at the time of the instant invention it was "less feasible" to develop the instant invention due to the "difficulty" of a "multivariate problem". This teaching is presented for a **traditional mesophilic biological sludge**; while, the difficulty is enhanced and the feasibility is reduced with the further complication of a **thermophilic biological sludge** (undue experimentation to develop the instant claims).

The above statements and teachings from June 1995 and August 1996 are while the parent application for the instant application, e.g. 08/721,557, was filed on 09/26/96. Therefore, at the time of the instant invention, "**means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water [was] poorly understood**". This is while at the time of the instant invention, Dentel 1995 and Chitikela 1996 demonstrate that "**the optimal amounts and types of conditioners required depending on a variety of factors**": 1) "**aqueous and surface chemistries of the sludge**", 2) "**physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed with the plant**", and 3) "**the chemistry of any chemical conditioner used, and how it interacts with the biosolids**".

These teachings at the time of the instant invention are while none of the cited references alone or in combination teach a "method for dewatering thermophilic biological sludge" comprising any of these factors; this is regardless of the application purpose of the instant claims to thermophilic biological sludge. The instant invention teaches the dewatering of a thermophilic biological sludge, e.g. 1) "aqueous and surface chemistries of the sludge" in column 2:

> Despite the disadvantages of mesophyllic bacteria, mesophyllic bacteria are preferable in relation to the dewatering of digested sludge. Mesophyllic bacteria naturally secrete a polysaccharide which acts as a tackifier providing a chemical mechanism of floc formation. This chemical mechanism is an aid to traditional cationic polyacrylamides to begin the dewatering process. However, thermophilic bacteria do not

> secrete a tackifying polysaccharide. Furthermore, thermophilic bacteria naturally repel each other. This repelling nature of thermophilic bacteria makes the dewatering of sludge from the thermophilic digestion process expensive and difficult.

The instant invention also teaches, 2) "physical properties of the suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed with the plant" in column 2:

> At temperatures of at least about 115° F., active bacteria are of the thermophilic variety. Aerobic and/or anaerobic thermophilic microorganisms are used to carry out any required degradation in a thermophilic, exothermic process. The thermophilic digestion system relies on high operating temperatures (greater than about 55° C. or 131° F.) to achieve a substantial pathogen destruction. While a fraction of the energy released from the thermophilic process is stored intracellularly to form new cells, a larger fraction of the energy is released as heat into the environment. The released heat is the major heat source used to achieve the desired operating temperature. Experiments have shown that between about 8,500 and 13,000 BTU are released with the thermophilic digestion of one pound of volatile solids (bacteria). By maintaining a sufficient temperature for a required period of time, pathogenic organisms are reduced to below detectable levels.

Lastly, the instant invention teaches, 3) "the chemistry of any chemical conditioner used, and how it interacts with the biosolids" in column 5:

> The significant improvements of this invention in sludge dewatering are accomplished by the addition of polyquaternary amines to the sludge. Di-allyl di-methyl ammonium chlorides (DADMAC) and epichlorohydrin di-methyl amine (epi-DMA) are two preferred polyquaternary amines used in sludge dewatering. Both of these polyquaternary amine moieties have been found to provide sites for the dewatering of sludge from the thermophilic digestion process.

And, again in column 7:

EXAMPLE 1

A bench test was performed utilizing an electrical variable speed beaker stir system, commonly referred to as a jar test. 2000 ppm of CV 3750 (20% active) were added to 500 mnl of sludge from the thermophilic digestion system. The percentage of solids in the sludge was about 4.4 percent. The beaker was allowed to stir at 120 rpm for 30 seconds. At 30 seconds, the rpm was reduced to 90 and 1500 ppm of CV 5120 in a 0.25 percent solution were added to the beaker. After 15 seconds, the stir speed was slowed to 30 rpm and mixed for another 30 seconds. Large, heavy floc (e.g. with a diameter of at least about 4 mm) was formed with a somewhat cloudy supernatant.

And, again in column 9:

EXAMPLE 7

A plant test was performed on Sep. 10, 1996 at the municipal wastewater treatment facility for the City of College Station Texas. This facility has a thermophilic digestion system as designed by Kruger, Inc. The average temperature of the digester is usually near 65° C. Dewatering is accomplished on a Sharpels Polymixer 75000 centrifuge. Polymer inversion is accomplished on a Polymixer 500 which is designed for a dry polymer. Normal plant operation requires 1500 to 2000 ppm of Nalco 9909 obtaining variable sludge cake dryness, a final centrate that is usually much over 200 ppm of total suspended solid and a plant throughput of 10 to 15 gpm sludge. The centrifuge was started up on CV 5380 and Nalco 9909 with the CV 5380 having a polymer concentration of 400 ppm and the Nalco 9909 having a concentration of 450 ppm. The centrifuge was run between 45 and 55 gpm of sludge throughput. The produced sludge was over 18 percent cake solids. The centrate was less than 50 TSS.

Therefore, at the time of the instant invention "means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water was poorly understood"; while it was known at the time of the instant invention that three teachings were needed to understand said means, all of which are taught by Applicant in the instant specification; again: "Aqueous and surface chemistries of the sludge"; "Physical properties of the suspended solids, which are determined by characteristics of the original wastewater and

by the operational parameters for the various treatment processes employed with the plant"; and "The chemistry of any chemical conditioner used, and how it interacts with the biosolids".

Therefore, as previously presented and is furthered herein, Applicant discovered "the source of the problem" and taught a solution to "the source of the problem" in the instant specification. This is while "the source of the problem" to dewater thermophilic biosolids was not taught or suggested by others, as was required in the art. Therefore, the instant claims could not have been obvious to one of ordinary skill in the art at the time of the instant invention.

This above is while the previously presented US EPA Document TBS Prakasam, et al. Effect of Recycling Thermophilic Sludge on the Activated Sludge Process, EPA Project Summary 5, Sept. 1990, **which is at the time of McGrow, e.g. 1991**, states under the heading of Dewaterability:

> "Capillary suction time (CST) measurements at various polymer dosages indicated that mesophilic sludge required a lower polymer dosage than did the thermophilic sludge (10 vs. 22.5 kg/dry tonne) to achieve the minimum CST that was possible. The thermophilic sludge, however, exhibited highest floc strength than did the messophilic sludge.
>
> Pilot scale centrifuge studies confirmed that the thermophilic sludge required a higher polymer dosage than did the messophilic sludge. At optimal polymer dosages, those studies also indicated that the mesophilic sludge approached 100% solids capture whereas the thermophilic solids approached a maximum of 96% solids capture. The lower solids capture with thermophilic sludge probably resulted from the higher concentration of fine particles in it than in the messophilic sludge."

The report goes on to recommend that:

> "Based on the lack of effect on sludge mass end the increase in digestion capability required, the Torpsy process is not recommended for Chicago's conventional rate activated sludge plants. Nor is thermophilic digestion as the terminal sludge digestion process recommended if the sludge is to be used at a site with nearby neighbors."

Therefore, the teachings of the instant invention were not obvious to the industry in September of 1990, wherein the US EPA, taught away from the instant claims **at near the same time of McGrow**; while again, in 1995 and 1996 the instant claims were taught away from by a recognized University Authority, as presented previous. Applicant refers the Examiner to MPEP 2141.02 VI; 2141.03 VI; 2144.05 III; 2144.07 III; 2144.08(c) & 2145 X D.

Applicant, then further, refers the Examiner to the declarations on file, wherein it is evidenced that there existed at the time of filing for the instant application, at College Station, Texas, a difficulty to dewater biological solids from a thermophilic digestion process while the

instant claims were not practiced; and wherein, it was only after teachings of Applicant that instant claim 1 was practiced in College Station, Texas, e.g. Allied Colloids. This fact is furthered in the declarations on file wherein the Examiner can note that at Texarkana, Texas it was only after teachings of Applicant that instant claim 33 was practiced in Texarkana, Texas. Therefore, at a time wherein all the Examiner's Citations were available, the instant claims were not obvious at two locations without the teachings of Applicant.

In addition, at the time of the instant invention, those of ordinary skill in the art would have had available the US EPA (1990), McGrow (1991), Dentel (1995) and Chitikela (1996) references. Therefore, for one of ordinary skill in the art to have developed the instant invention and the instant claims from the Examiner's Citations, at the time of the instant invention, one of ordinary skill in the art would have had to: 1) apply McGrow to the dewatering of thermophilic bio-solids when there is no teaching in McGrow in relation to thermophilic bio-solids, 2) apply Eberhard in the use of a cationic polyacrylamide while ignoring the fact that a cationic polyacrylamide alone is unsuccessful in the watering of thermophilic bio-solids, as evidenced in the instant invention, and so taught by McGrow, 3) ignore the teachings in McGrow, which refer to gelatin formation and coring, which is related to overdosing, none of which is a challenge with the dewatering of thermophilic bio-solids, as evidenced in the instant specification, 4) ignore the teachings of Dentel 1995 and Chitikela 1996 and apply a polyquaternary amine anyway as a pre-conditioner, 5) ignore the teachings of the US EPA, a pre-eminant authority, while 6) replacing both the enzyme and the chelant in Eberhard with a polymeric quaternary ammonium compound against the teachings of Dentel 1995 and Chitikela 1996.

Applicant presents that such an irrational path is not a path for one of ordinary skill in the art; or quite frankly, for one of expert skill in the art; as, there are just too many irrational decisions which must be made with the cited references at the time of the instant specification without having the instant claims or teachings in the instant specification. This is while, due to teachings of McGrow, the only reason to go against Dentel 1995 and Chitikela 1996 would be in the instances of **"coring"** or of **"gelatin formation"** due to **"overdosing"**, none of which is remotely an issue with the dewatering of thermophilic bio-solids. This is all while the instant invention is for a different purpose, e.g. the dewatering of **"thermophilic"** bio-solids; and, it would have been obvious to one of ordinary skill in the art that the dewatering of thermophilic bio-solids is a **"different purpose"** than the dewatering of mesophilic bio-solids; as, mesophilic

bio-solids are traditionally dewatered with a cationic polyacrylamide; while, as taught and demonstrated in the instant invention, thermophilic bio-solids are difficult at best to dewater with a cationic polyacrylamide. **Therefore, to one of ordinary skill in the art, the dewatering of mesophilic bio-solids and the dewatering of thermophilic bio-solids are different purposes.**

Given the requirements for and rather irrational decision making required for one of ordinary skill in the art at the time of the instant invention to develop the instant invention, Applicant respectfully states that the Examiner's cited combination, e.g. Eberhard in view of Williams and McGrow is "hindsight reconstruction". Applicant refers the Examiner to MPEP 2144.06, 2141.01III and 2145 X, as well as, ***KSR International Co. v. Teleflex, Inc., et al***[1].

Applicant would like to respectfully quote MPEP Section 2143.03 which states, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious *In re Fine*, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988".

Applicant respectfully requests an allowance of instant claims 1-2, 4-8, 10-16, 22, 24-28, 33, 35-37, 41, 44, 45-48, 51-55, 58, 67-70 and 73 as presented herein.

Examiner Rejection

Claim 14 is rejected under 35 USC Sec. 103(a) over Eberhard, McGrow, Payne and Willliams, as applied to claim 1 above, further in view of USP 3397139 to Sak. Sak teaches it was conventional to dewater combined primary and secondary sludges. Accordingly, it would have been obvious to have mixed Eberhard's sludge with primary sludge before thermophilic sludge treatment of the same, as suggested by Sak.

Applicant's Response

Applicant appreciates the effort afforded by the Examiner in preparing his response. Applicant would like to respectfully quote MPEP Section 2143.03 which states, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious *In re Fine*, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988". As Applicant has respectfully traversed the Examiner's Rejection of claim 1, from which claim 14 depends, Applicant respectfully requests an allowance of claim 14 as presented.

[1] ***KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398 (2007).**

Examiner Rejection

Eberhard, McGrow, Willliams, and Coscia, Tanaka, or Neff

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Eberhard, McGrow, Payne and Willliams, as applied to claim 1 above, further in view of USP 4137165 to Coscia, USP 4155847 to Tanaka, or USP 5405554 to Neff.

Applicant's Response

Applicant would like to respectfully quote MPEP Section 2143.03 which states, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious *In re Fine*, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988". As Applicant has respectfully traversed the Examiner's Rejection of claim 1, from which claim 3 depends, Applicant respectfully requests an allowance of claim 3 as presented.

Examiner Rejection

Eberhard and Payne

Claims 33, 35, 38, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over USP 5019267 to Eberhard and McGrow, as applied to claim 33 above, further in view of USP 5178774 to Payne.

Applicant's Response

Payne teaches for a different purpose; Payne teaches for the dewatering of minerals. Specifically, in the Abstract, Payne teaches:

> An aqueous suspension of coagulatable material is coagulated by adding polymeric coagulant to the suspension and then separating the resultant coagulated material from the liquor. The coagulatable material may be present in the aqueous suspension as a suspension of suspended solids or as colloidally dispersed solids. The suspension may be coal tailings or other aqueous (generally mineral) suspension.

Emphasis added

Further, none of the Examiner's cited references teach treating a thermophilic biological sludge, or any sludge, singularly with a polymeric quaternary ammonium compound, as claimed in instant claim 33:

33. A method for dewatering a sludge comprising water and thermophiles, the method comprising:

adding to the sludge a polymeric quaternary ammonium compound.

Payne is totally silent on the dewatering of thermophilic sludge or any type of biological sludge for that matter. To be sure of this fact, after reviewing Payne manually, Applicant obtained an electronic copy of Payne at uspto.gov and performed a word search for: "biologic", "meso", "thermo" and "municipal"; none of these are even located in Payne.

As previously presented, Eberhard does <u>not</u> teach a polymeric quaternary ammonium compound; while, McGrow is for a different application (purpose) than the instant claims.

In regard to claims 35, 38 and 40, Applicant would like to respectfully quote MPEP Section 2143.03 which states, "If an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending there from is non-obvious *In re Fine*, 837 F2d.1071, 5 USPQ 2d 1596, Fed. Cir. 1988." As Applicant has respectfully traversed the Examiner's Rejection of claim 1, from which claim 4 depends, Applicant respectfully requests an allowance of claims 35, 38 and 40 as presented.

Claim Allowance

Applicant respectfully requests allowance of claims 1-8, 10-16, 22, 24-28, 33, 35-38, 40, 41, 44-48, 51-55, 58, 67-70, and 73 as amended and/or presented herein.

Conclusion

Applicant respectfully requests entry of this Office Action Response, along with favorable reconsideration of the pending claims. Applicant has respectfully provided to the Examiner facts and argument which support allowance of the instant claims. Specifically, Applicant has respectfully provided to the Examiner relevant facts and argument relating to: teaching away by notable published references at the time of the instant invention; discovery of the source of the problem by Applicant, as evidenced in the instant application and as required by notable published references at the time of the instant application; hindsight reconstruction, as evidenced in the Examiner's Citations both at face value and when taken in context to notable publications at the time of the instant application; copying by others, after Applicant's teachings, as evidenced in secondary considerations; and commercial success by others, after Applicant's teachings, as evidenced in secondary considerations. Applicant has also presented that many of the Examiner's Citations are for a different purpose than that of the instant claims.

This response places the claims in a condition for allowance. Applicant requests that in view of this fact, this Office Action response be entered, and after due consideration of the respectful presentation herein, the claims be allowed and a certificate be issued.

This is an old file; therefore, to avoid an Appeal and potential Appeal to the Federal Court of Appeals, as well as to facilitate resolution of any issues or questions, Applicant respectfully requests that the Examiner directly contact the undersigned by phone to further discussion, reconsideration and allowance of the instant claims.

Respectfully submitted,

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